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Central Intelligence Agency



Washington, D.C. 20505

DIRECTORATE OF INTELLIGENCE

16 OCT 1985

MEMORANDUM FOR: Ronald K. Lohrding
Assistant Director for Industrial
and International Initiatives
Los Alamos National Laboratories

VIA: David Wigg, Deputy Director
International Economic Affairs
National Security Council

FROM:
Director of Global Issues

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SUBJECT: Guatemala: Assessment of Petroleum Potential 25X1

Attached, per your request, is an economic and geologic
assessment of the petroleum potential of Guatemala. If you have
any questions, please call

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Attachment:

Guatemala: Assessment of Petroleum Potential
GI M 85-10258, October 1985,

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SUBJECT: Guatemala: Assessment of Petroleum Potential

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OGI/SRD/PRB (11 Oct 85)

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DIRECTORATE OF INTELLIGENCE11 October 1985Guatemala: Assessment of Petroleum PotentialSummary

Geological analysis indicates that Guatemala may have an undiscovered oil resource base of about 500 million barrels, supplementing current proved reserves of 30 million barrels. This would be more than adequate for Guatemala to become energy self-sufficient if these resources could be developed. In our judgment, however, commercial development of all but a fraction of its resource base is in doubt during the next 10-15 years. Oil reservoirs in Guatemala are small and relatively deep, making drilling difficult and expensive. We estimate that to achieve self-sufficiency, an annual oil company investment budget—for exploration drilling alone—of at least \$150 million would be required. It is highly unlikely that such a level will be achieved because of the current unfavorable investment climate in Guatemala and the soft international oil market. [redacted]

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Although oil self-sufficiency will remain elusive, Guatemala has the potential to increase oil production and reduce an oil import bill now totalling more than \$200 million annually. Since international oil companies would have to foot the investment bill and share eventual production with the Guatemalan government, oil production from new discoveries permits some reduction in Guatemala's expenditures on oil imports. Unless these investments are made, Guatemala's production out of current fields will continue its rapid decline. With a return to even the modest foreign investment levels reached in the early 1980s, however, output in the nineties could be held in the 5,000-6,000 barrels per day range, not much below the previous peak levels of about 7,000 barrels per day reached in the early eighties. This could eventually result in annual hard currency savings of as much as \$20 million at present oil price levels. Under the current petroleum law, however, foreign oil companies have little incentive to expand exploration and development work. [redacted]

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Even though the current soft oil market has a dampening affect on exploration activities in marginal areas, we believe activity in Guatemala will accelerate if the investment climate is improved. In our judgment this would require, at a minimum, revisions in several restrictive elements of the 1983 Petroleum Law in order to reduce government oversight and improve the financial environment for foreign oil companies. Further reductions in the maximum government share in production, relaxation of penalties for failing to

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meet drilling schedules, and improvements in the ability of companies to recover costs would significantly brighten the outlook for faster development of the reserve base especially when the international oil market begins to show signs of firming. We believe Guatemala will eventually allow additional incentives in order to boost domestic oil production and reduce pressures on its hard currency balance. [REDACTED]

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This memorandum was prepared by [REDACTED]
[REDACTED] Petroleum Resources Branch, with a contribution from [REDACTED]
Terrorism Analysis Branch, Office of Global Issues. The information contained herein is updated to 11 October 1985. Comments may be directed to [REDACTED]
[REDACTED] Chief, Strategic Resources Division, [REDACTED]

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Guatemala: Assessment of Petroleum PotentialIntroduction

Oil exploration in Guatemala started in the 1920s but high production costs made commercial development unattractive. Enthusiasm about Guatemala's possible petroleum resources was rekindled in the 1970s both in response to rapidly increasing world oil prices and on the hope that the country sat on the same geologic trend that contains Mexico's large onshore oil fields discovered in the early-1970s. When subsequent exploratory work indicated that this did not appear to be the case, enthusiasm waned. Nevertheless, the geological conditions in Guatemala still suggest the potential to reduce oil import costs. An improved investment climate, however, must be established to attract the necessary investment by foreign companies. []

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Recent Developments

Guatemala's oil requirements are modest but drain a significant portion of available foreign exchange. Domestic consumption peaked in 1979 at almost 32,000 barrels per day (b/d) falling steadily thereafter to about 23,000 b/d in 1983. The reduction was due in part to lower economic growth, the rise in domestic fuel prices to near world levels and the substitution of hydroelectric power for oil-fired electricity generation. Moreover, the Nickel Company--a major consumer of fuel oil--closed in 1980. Last year, however, we estimate the Guatemalan economy grew slightly after two years of decline. As a result, oil consumption edged up and is now averaging close to 25,000 b/d. []

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During the past five years Guatemala has relied on imports to cover about 95 percent of its domestic oil needs. The country receives all of its crude oil imports from Mexico and Venezuela under terms of the San Jose Accord which provides concessionary oil financing, somewhat lowering the oil import burden. This accord--which was revised last August and is open to renewal annually--currently provides for delivery of up to 15,000 b/d of crude oil, with Mexico supplying 7,000 b/d and Venezuela providing the remainder. Historically, however, Guatemala has purchased a total of only about 13,000 b/d from Mexico and Venezuela which it processes at the country's only active refinery in Esquintla. Guatemala satisfies the remainder of its oil needs by importing refined petroleum products from United States and various Caribbean suppliers. Guatemala's net petroleum import bill reached about \$355 million in 1981; although net petroleum import costs fell to below US \$200 million last year, this still represented nearly 20 percent of total commodity export earnings. []

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The oil imports bill is aggravating a fragile international balance of payments situation. Recent figures from the Guatemalan Finance Ministry show that government foreign exchange flows are inadequate to cover both debt service and essential imports. Indeed, Mexico and Venezuela have curtailed crude oil deliveries until Guatemala initiates a repayment plan for an estimated \$34 million in overdue bills. Refined petroleum supplies from U.S. exporters are inadequate to cover the crude shortfall. As a result, fuel shortages are becoming widespread causing long gas lines and the imposition of a strict rationing program. []

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Looking Ahead

In our judgment, petroleum demand is likely to rise to a range of 30,000-35,000 b/d by 1990 if Guatemala can maintain a moderate economic growth rate averaging 2-4 percent per year. Although Guatemala's oil dependency could be reduced if its hydroelectric resources are developed, high development costs are likely to discourage investment. Guatemala's hydroelectric resources--the largest in Central America, estimated by an industry source at 10,000 megawatts (MW)--represent, in principle, the oil equivalent of about 70,000 b/d. Total installed hydroelectric capacity is currently less than five percent of potential, but accounts for roughly one third of all electricity generation. Thermal power plants produce the remainder and require nearly 4,500 b/d of oil or about 20 percent of total petroleum consumption. []

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We believe development of hydroelectric power will slow partly due to Guatemala's bad experiences with the Chixoy hydroelectric plant. Construction of the Chixoy plant--which could replace 1400 b/d of oil--began in 1978 but architectural failures have caused delays in construction and cost overruns in excess of \$300 million. The final cost of this project, estimated to be over \$800 million, will be a financial drain on the Guatemalan economy for years. Moreover, according to U.S. Embassy reporting, a U.S. power-generation team has downgraded the actual maximum generation capacity from 300 MW to only 200 MW. The date of operation for the Chixoy plant remains uncertain. According to government officials, repair work should be completed by this October when the plant will begin testing before being put in operation in early 1986. If problems are encountered during the testing phase, needed repairs may further delay operation. As a result, electric power sector demand for oil is likely to remain substantial over the near to medium term. []

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Current Oil Output

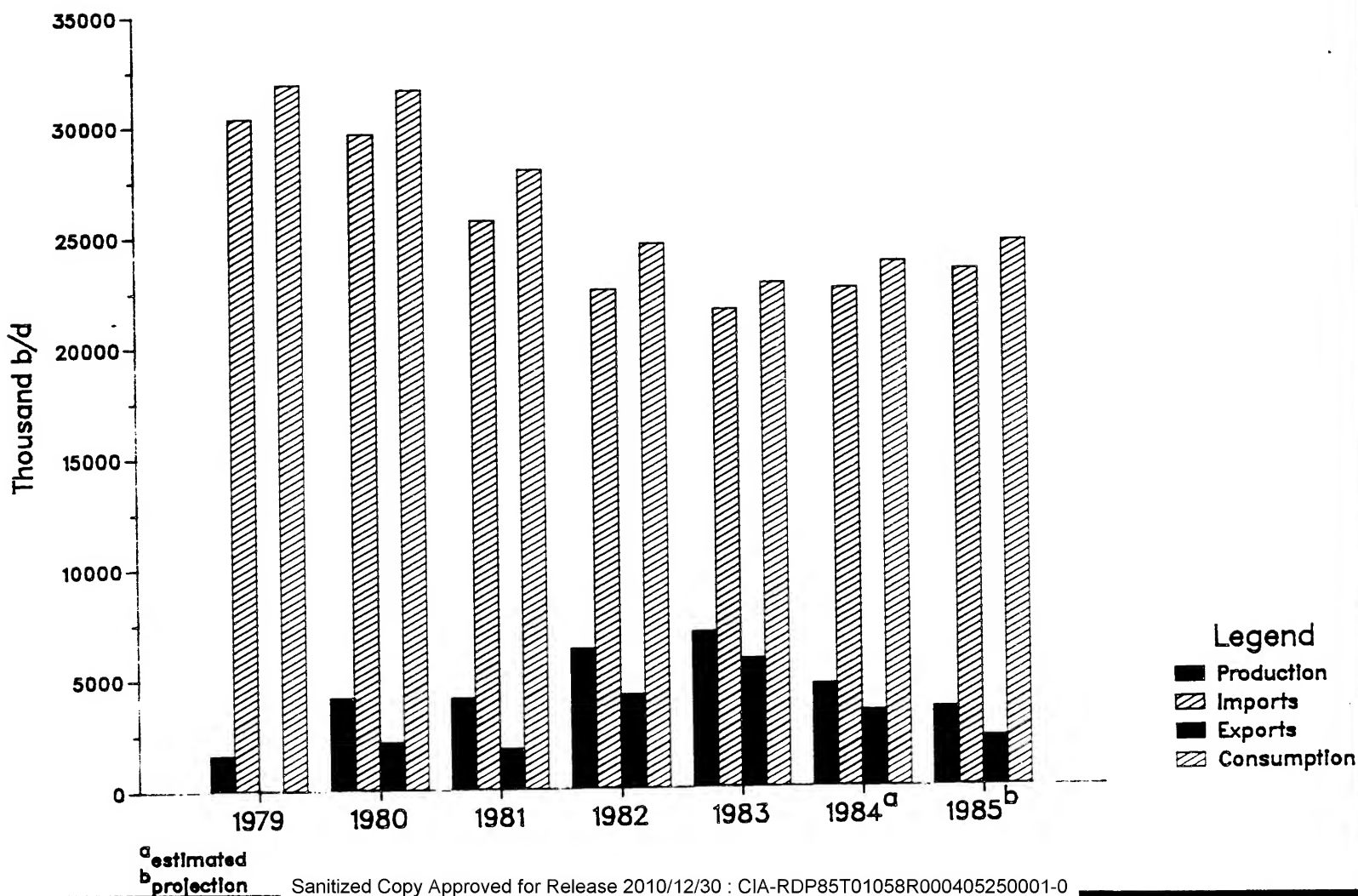
It was not until the late-1970s with the development of the Tortugas, Rubelsanto, and West Chinaja fields in the Chapayal Basin that Guatemala became an oil producer, albeit on a minor scale. Oil output peaked at about 7,000 b/d in 1983, falling to about 4,500 b/d in 1984 because of poor field performance and a lack of investment. (Figure 1)

- o The primary producing fields--Rubelsanto and West Chinaja--have not lived up to early expectations, and are currently producing between 3,000-4,000 b/d.
- o In 1982, the Caribe field came on-line with a production rate of only 900 b/d. Output dropped to about 500 b/d in 1984.
- o For a short period the Tierra Blanca and Tortugas fields were producing close to 400 b/d. Because of declining well flow rates, production from these two fields was suspended in July 1984. []

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Guatemalan crude has a high sulfur content and is not refined domestically. As a result, most of it is exported and the remainder is limited to direct burning in electricity generation and cement production. Exports began in 1980 upon completion of the Petromaya pipeline and peaked in 1983 at almost 6,000 b/d from which Guatemala earned about US \$60 million.

FIGURE 1
GUATEMALA: TRENDS IN THE OIL SECTOR



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Because of the drop in output, however, exports have decreased by about 50 percent since 1983. []

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The Potential Resource Base

Modest oil discoveries in the late-1970s and early-1980s attracted foreign interest and created an optimistic outlook for the oil sector. Interest in Guatemala was spurred by industry and trade reports suggesting that regions of the country could be geological extensions of the huge Reforma area of southern Mexico, where reserves have been estimated by the Mexican government at some 10 billion barrels. The expectation prevalent during that period that world oil prices would remain buoyant, further stimulated oil companies' interest in Guatemala. By 1983, four international consortia were operating in five contract areas. Drilling activity peaked in 1982 with the completion of 12 development and nine exploratory wells, but no major discoveries were made. We estimate that during 1978-84 over \$750 million was spent on exploration and development in Guatemala. []

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The failure to find significant deposits has quickly depressed oil company interest in Guatemala's potential. []

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[] we estimate the proved oil reserves in Guatemala presently amount to only 20 to 40 million barrels (see Appendix 1). At the mid-point of the range, this amount represents less than a four year oil supply at the country's current rate of consumption. All of this oil is located in the Chapayal Basin in the Peten lowlands. Despite the large investment--at least by Guatemalan standards--that has been made in oil exploration programs in recent years, the results have been generally disappointing. We believe that one of the major factors contributing to the limited success thus far has been that the amount of drilling carried out is small compared to the fairly large area that needs to be explored. In addition, the sharp turnaround in the world oil market between the late-1970s and mid-1980s, combined with a restrictive investment climate, led to the premature end of exploration drilling by foreign oil companies. []

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We still believe, however, that the potential reserve base is much larger. Based on a geological analysis of the available data, we estimate that proved and potential oil reserves in Guatemala amount to between 420 to 640 million barrels.¹ Our analysis indicates that upwards of 80 percent of Guatemala's potential oil reserves lie in the Chapayal Basin. Other regions of the country that may contain oil include the Amatique Subbasin, the Yucatan Platform, and the Pacific Coastal Basin (see Appendix 2). []

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¹Proved reserves are estimated quantities of crude oil that geological and engineering data demonstrate with reasonable certainty to be recoverable from known reservoirs under existing conditions. Potential reserves are estimated amounts based on less conclusive geological and engineering data. These reserves are on structures where production has not been established but where potential might exist based on structure and productivity extrapolation from developed areas. []

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Development and Production Costs

Development of Guatemala's oil potential is likely to be expensive. The cost of oil development and production varies widely on a worldwide basis. Key considerations are the size and productivity of the deposits and the quality of the crude oil itself. Drillings costs vary according to the depth of the oil-bearing structure and the geology of the overlaying formation. Difficult terrain or climatic conditions also increase costs. The availability of processing facilities to remove corrosive contaminants and the proximity of infrastructure--such as roads, pipelines feeding refineries and export terminals--are major other factors affecting development costs. Virtually all of the factors that push costs up are at play in Guatemala:

- o The oil pools that have been found thus far are small and are fairly deep.
- o Most of this oil is high in sulfur, which must be removed before it can be safely transported through pipelines.
- o In most cases, pipelines do not extend into the producing areas. After extraction and the removal of sulfur, the oil must now be moved by truck to the pipeline. [REDACTED]

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Because of these factors, exploration and development of Guatemala's oil reserves has proven more difficult and expensive than originally believed. Average well depths in the Peten Basin, for example, are about 3,300 meters--ranked as moderately deep wells by international standards--and most are overlaid with limestone. Drilling in the Peten Basin takes, on average, three to six months and the wells are estimated to cost \$10-\$20 million a piece. As a rough comparison, in the Williston Basin of North Dakota, where infrastructure is more developed, wells drilled to about the same depth as those in the Peten Basin would cost between \$700,000 and \$1.5 million and probably be completed in a month. Moreover, most of the reservoirs in the Peten Basin are highly fractured, a factor that increases the likelihood of a well blowout during drilling. Although complete data are not available, we believe that average drilling costs in Guatemala are at least four times as much as those in the nearby Reforma area of southern Mexico. [REDACTED]

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Because of the remote location of the oil deposits, their small size, and poor quality, production costs in Guatemala rank among the highest in the world. Elf Aquitaine was claiming costs of \$7.00 per barrel at Rubelsanto and \$12.50 per barrel at Caribe in late 1983. These costs probably match those posted by producers operating in stringent conditions such as the North Sea--normally regarded by industry experts as one of the world's highest cost, oil producing regions. Consequently there is little incentive for companies to engage in these high cost operations--especially with the uncertainty regarding future oil prices--when they could realize a heftier return on their investment by operating elsewhere (see Appendix 3). [REDACTED]

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Government Policies as Constraints

In the case of Guatemala, government policies further increase costs. The Guatemalan government is not directly involved in petroleum production and marketing, but does tightly regulate oil exploration and development,

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[redacted] Guatemala's stringent petroleum laws reflect strong nationalism and an overly optimistic view of its oil potential. As a result, Guatemala was slow to improve financial incentives and investment activity declined during the early 1980s because of rising exploration costs and limited potential. [redacted]

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In an effort to attract new foreign investment Guatemala revised its petroleum law in 1983. Under the new law, the minimum government share in production that the government keeps for its own use or for resale was reduced from 55 percent to 30 percent. The government share, however, escalates as output increases and can still rise to as much as 70 percent. Foreign oil companies are now allowed to recover some exploration and development costs before turning over the government's share--the exact costs that can be deducted are not specified under the law and vary among contracts. Moreover, contract fees have been reduced and, as a result of revisions that now allow income taxes paid to the Guatemalan government to be creditable against US taxes, the tax burden has been lessened. To attract small and medium size firms, the maximum size of contract blocks has been reduced from 200,000 hectares (772 square miles) to 80,000 hectares (309 square miles) offshore and 50,000 hectares (193 square miles) onshore. [redacted]

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Despite Guatemala's attempts to improve the investment climate, contract terms remain--in general--overly restrictive and financially burdensome, [redacted]

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- o Government interference in oil operations remains pervasive. The Secretariat of Energy & Mines is required to approve daily activities of the foreign operators. Moreover, the Ministry is authorized to inspect the company's budget before work programs are executed.
- o The companies are required to buy back--at \$2-\$3 above market prices--that portion of the government's share of oil not used for internal consumption.
- o As a further disincentive, once the oil companies declare a discovery as commercial, contractors must pay the government \$50,000 for each area that will be developed.

Some industry analysts have speculated that Guatemalan officials have been slow to reduce investment barriers in the hope of forming a national oil company, possibly one similar to the Mexican state oil company. The new petroleum law does not establish a state-owned oil company but it also does not prevent the National Petroleum Commission--a government body which oversees petroleum activities--from evolving into one. Although internal rivalries have made such a venture virtually impossible, fear of potential nationalization may further dampen foreign interest in Guatemala. [redacted]

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On balance, we believe the new petroleum law does not provide incentives adequate to offset the substantial cost involved in exploration and development. Indeed, in 1983, four contract areas were relinquished, despite the passage of the new petroleum law:

- o Texaco and Amoco relinquished their block D lease which was acquired in 1978. This group was obligated to spend a minimum of \$11.5

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million, including drilling two wells to at least 4000 meters. (Figure 2) Although some oil was found, production would not have covered the cost of development.

- o Hispanoil and its partners relinquished Block E and their producing areas in Block AA. The Hispanoil group was committed to a minimum investment of \$12 million over three years in Block AA, which included drilling three wells to 3000 meters. They drilled two dry holes and found two minor producers--including the Yalpemach field which tested at 1,000 b/d--but subsequent drilling indicated that the field was too small for commercial development. [REDACTED]

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o [REDACTED]

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Remaining in the country are Hispanoil and Basic who are currently seeking a replacement for Elf Aquitaine. Texaco and its partners in Block L have also converted to the new petroleum law and have continued drilling operations in the Northwest region. The Texaco consortium is required to drill one well per year to at least 4,500 meters for an additional two years. [REDACTED]

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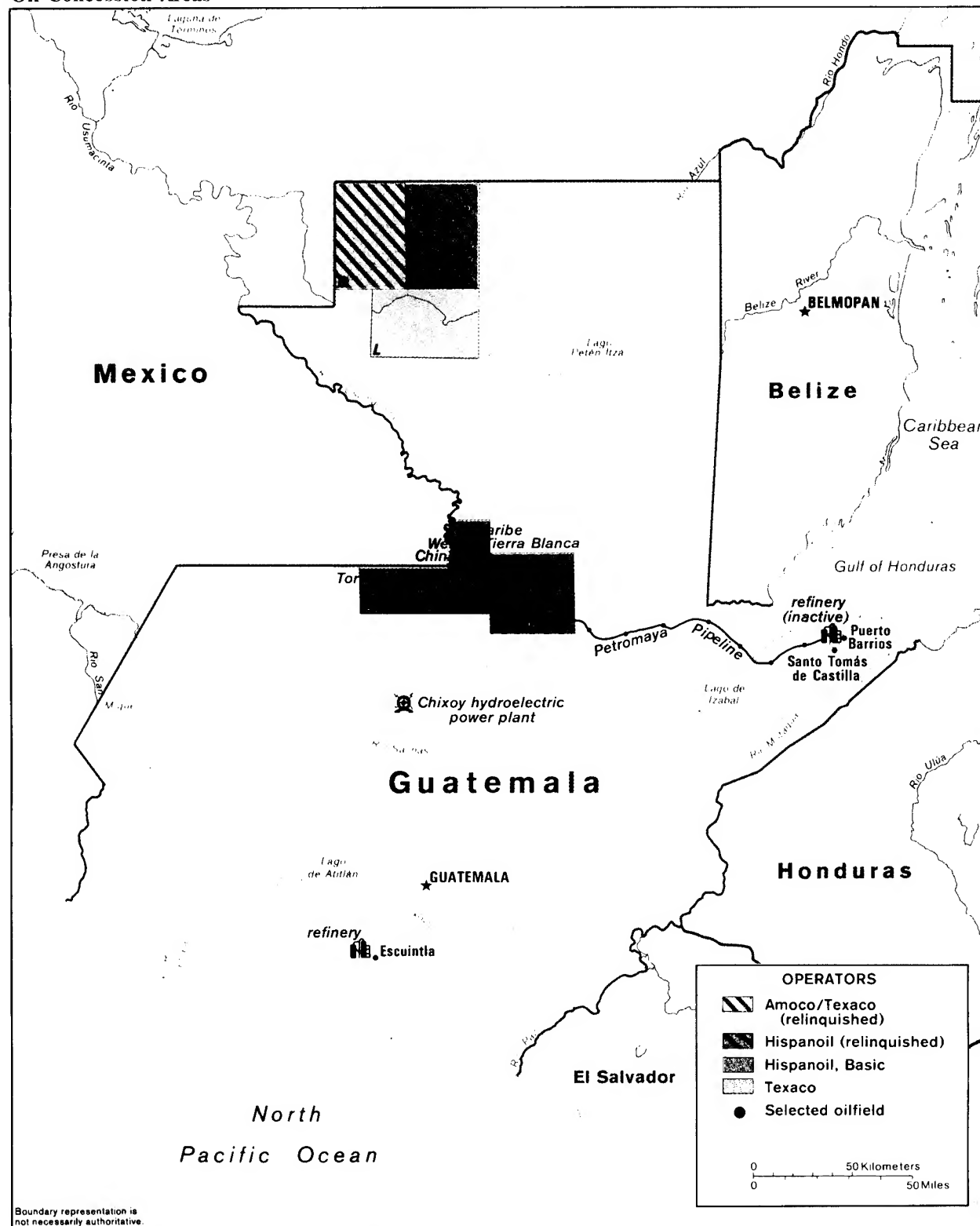
Last fall, the government called for bids on the areas that Texaco and Hispanoil had relinquished in 1983. So far only one major foreign oil company has made a bid although several other companies have shown some interest in these and other areas. According to Embassy reporting, Exxon has tentatively signed a contract to explore in the Peten area. While this is a necessary first step, Exxon's initial investment of \$30 million over the next three years, is only a portion of the total needed. In our judgment, additional modification in the petroleum law will be necessary to yield significant new contractual commitments. Indeed, Guatemala has requested US companies to provide suggestions for possible revisions to its current Petroleum Law. We believe that most oil companies probably are coming to the conclusion that under current investment terms the potential in Guatemala is simply too small to be economically worthwhile to them. In particular, smaller firms--which are looking to diversify operations overseas--may lack the financial resources needed to cover the high costs of operating in Guatemala under current government policies. [REDACTED]

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Development Prospects and the Need for Improved Incentives

While we believe Guatemala has an oil resource base worth developing, the near term situation is likely to show little improvement. Indeed, production could drop even more if foreign companies continue to limit operations in light of the soft international oil market and the Guatemalan government fails to take necessary steps to improve the investment climate. Under the present investment climate, we see little likelihood of any major step-up in oil exploration and development programs in Guatemala for the foreseeable future. Furthermore, the current soft oil market will encourage producers to

Figure 2
Oil Concession Areas



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cut back marginally profitable operations; those in Guatemala would certainly rank high on the list. For the next few years at least, Guatemala will be lucky to hold on to foreign companies that are still operating in the country. Indeed, Texaco appears ready to follow the three companies who have already suspended operations in Guatemala in the last 18 months [redacted]

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[redacted] Even with an eventual firming of the oil market, international oil companies are not likely to become more active in Guatemala unless investment incentives are increased. [redacted]

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Without significant new investment, Guatemala's production will probably decline by the early to mid nineties to about 2,000 b/d, according to our analysis. In order to achieve self-sufficiency at around 30,000-35,000 b/d, we estimate that annual exploration expenditures of at least \$150 million would be necessary. Development costs could add more than \$500 million per year to the required total. It is doubtful that these amounts would be forthcoming under any reasonable scenario. For Guatemalan production to return to near its previous output peak, however, would require an annual average investment of only about \$20 million for exploration and another \$60-\$80 million for development--a level similar to historic expenditure rates (Figure 3). With this more realistic investment level, only a small portion of the potential reserves--perhaps only 15 million barrels of oil--could be discovered and developed over the next 10-15 years. Since the investment bill would be covered by the oil companies and the eventual production shared with the Guatemalan government, even this small gain in output would provide some savings in hard currency expenditures, perhaps as much as \$20 million per year at current oil prices. [redacted]

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If Guatemala is going to attract the capital necessary to reverse the downward trend in oil output, additional improvements in the investment climate are needed to balance the substantial risks and costs involved in oil exploration and development. Even if Guatemala were to relax restrictive provisions of the 1983 petroleum law and make it more attractive for foreign companies to operate in the country, increased oil exploration and development is by no means assured nor could any immediate results be expected. Three major companies, however, have already expressed a willingness to invest the needed capital if Guatemala eases restrictions. Because of the leadtimes involved in bringing new fields into commercial production--5 to 10 years--a significant increase in Guatemalan oil production is unlikely until the 1990s at the earliest, even if a major development push started immediately. [redacted]

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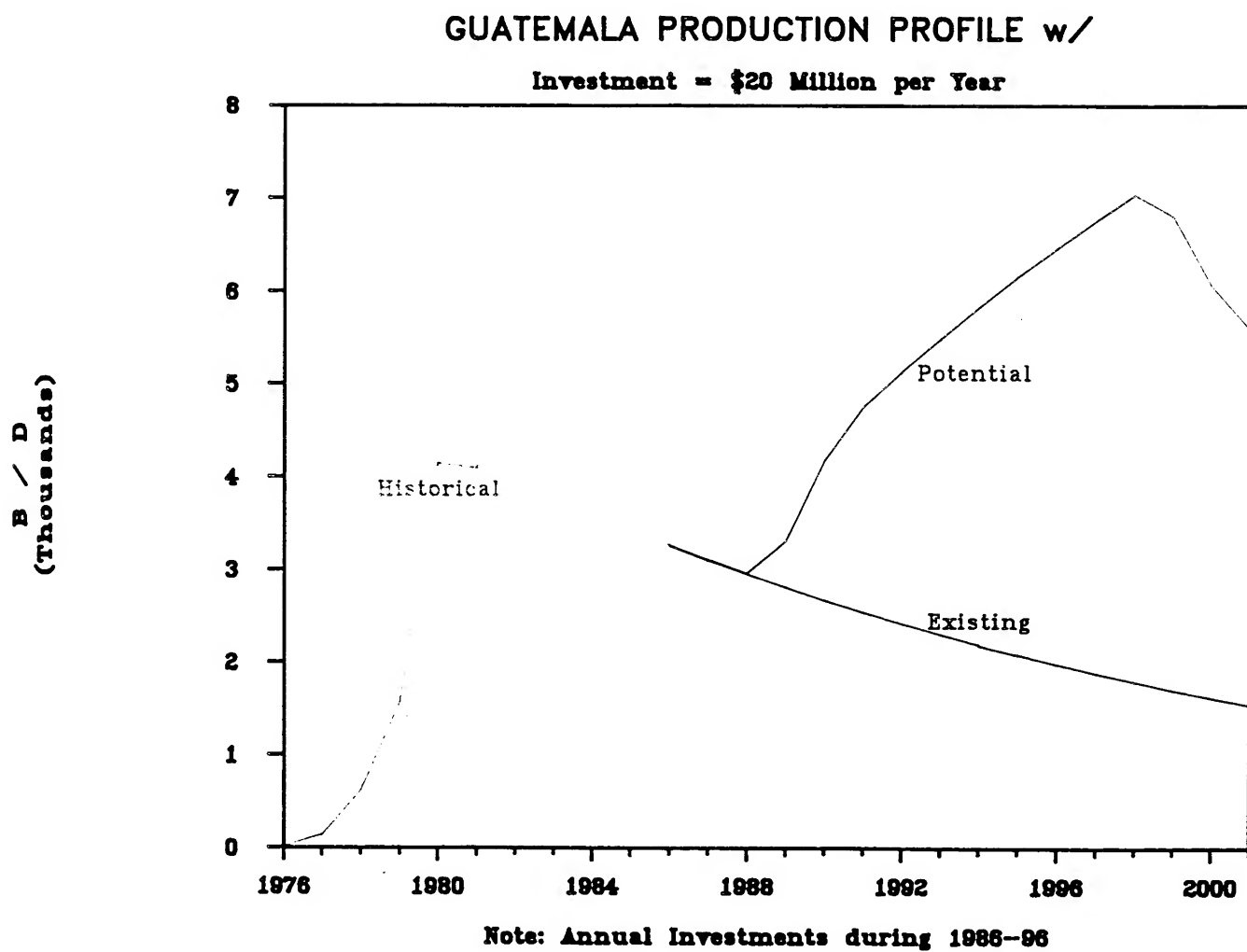
We believe several amendments to the existing petroleum law could be helpful in attracting additional foreign investment:

- o Further reductions in the upper end of the range of the government's share of production.
- o Increases in the time period in which a company must fulfill its drilling obligations and/or a relaxation of penalties for time overruns. Under the current law, there are no allowances for delays beyond a company's control and stiff penalties are exacted.
- o Reduction in the amount of government control and supervision over a company's activities.

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FIGURE 3

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- o A uniform definition of exactly what costs will be recoverable by the companies, whereas now this matter is handled on a case-by-case basis.

In our opinion, the soft oil market will also discourage more aggressive exploration and development in high risk, high cost areas like Guatemala. Without further improvements in the operating climate, however, it will be difficult for Guatemala to attract additional investment, regardless of oil market conditions. [REDACTED]

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The influence and control the Guatemalans would forego if these modifications were carried-out would be offset by the economic benefits achieved over the long run. The government would still receive almost 50 percent of all domestic production at no charge. Furthermore, although oil is not a labor-intensive industry, some jobs would be created throughout the country. Since Guatemala does not have to invest any of its own financial resources, any oil exploration and development would improve its economic outlook. The extent of that improvement, however, would depend on how much the government share would have to be reduced in order to attract required investment. In order to avoid short-term losses from reduced government take on current production, Guatemala could establish a two-tier system where revised investment rules would only apply to new operations.

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Appendix 1Estimating Oil Reserves

Estimates of possible Guatemalan oil reserves were derived through a combination of procedures. The estimate of proved reserves--roughly 20 to 40 million barrels--was derived from volumetric calculations of oil-in-place and recovery factors of 25-50 percent for the producing fields and from published reports. The estimate of possible reserves in the major producing region of Guatemala, the Chapayal Basin, was made by first selecting a sample area in the deeper part of the basin in which prospective structures had been mapped and projecting the productivity from known fields to the mapped prospects in the sample area. The potential of the entire basin was then estimated by extrapolation from the sample area to other parts of the basin. Our best estimate is that about 80 percent of the country's possible oil reserves--very roughly between 335 and 510 million barrels--lie in the Chapayal Basin. [REDACTED]

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The estimates of possible reserves in other prospective areas of Guatemala represent nominal amounts which were selectively attributed to the various regions in which there are indications of the presence of petroleum deposits, but in which there is insufficient actual data to support a more positive evaluation. The estimate of possible reserves both in the Chapayal Basin and other potential regions of the country is subject to a considerable range of error in either direction.

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Appendix 2The Geology of Guatemala

The three factors necessary for the accumulation of oil are source beds, traps and seals. Source beds are usually organic-rich, black, marine shales that will generate oil when subjected to sufficiently high temperatures caused by the depth of burial for a period of time. As the oil is generated it is ejected from the source beds into traps or reservoirs which are formed by a number of geological mechanisms such as folding and faulting. Reservoir seals are impervious barriers of sediments which cover the reservoirs thus preventing further oil migration either upward or laterally. []

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In Guatemala, the production of oil, even on a small scale, has established the general presence of source beds and migration routes to reservoirs. By the same token, the presence of traps can be inferred by various types of geological mapping and by photogeological interpretation. In the Guatemalan fields, the reservoir rocks are not highly porous and therefore cannot hold much oil. The seals are believed to be anhydrites and shales--normally excellent sealing agents--but some of them are believed to have been damaged or destroyed as a result of earth movements in this area. []

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Guatemala is situated between the Yucatan platform on the north and the Central American platform on the south. The country can be divided into three geological provinces: (a) the narrow Pacific coastal plain in the south; (b) the Guatemalan highlands in the center; and (c) the Peten lowlands in the north. The Northern and the Southern Central American mountain belts appear to merge into a single belt in the Peten lowlands and the Guatemalan highlands. The Peten lowlands, located between the Yucatan Peninsula and the Sierra del Sur is a geologically complex, active region which includes the Chapayal Basin, Guatemala's most likely prospect for finding oil in the near future. Even though the possibility of finding new fields in the basin is good, our geological analysis indicates that the reservoirs probably will have only limited storage capacity and hopes for finding "giant" fields are remote. Despite the proximity of the huge Reforma fields in southern Mexico to Guatemala's oil bearing regions, the characteristics of the oil reservoirs in both areas are completely different. There is little reason to expect that the oil potential of Guatemala could begin to approximate that of Reforma. []

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Regions in Guatemala considered favorable for generation and accumulation of petroleum include the Chapayal basin, the Amatique subbasin, the Yucatan platform north of the Libertad Arch and the Mayan Mountains, and the Pacific Coastal Basin. (Figure 4) []

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After Meyerhoff, 1976

Chapayal Basin

There has been little or no exploration development in the past few years to improve our evaluation of the prospective potential of the basin. In fact, several of the discoveries have failed over time to sustain economic rates of production, and a number of giant structures with significant potential have been drilled but have failed to establish any production. Failure to find oil in these large structures indicates that reservoir seals have been damaged during earth movements in this region, allowing the oil to migrate to the surface or another structure. [REDACTED]

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The Rubelsanto and West Chinaja fields, which account for nearly all of Guatemala's present production, prove the presence of adequate source beds and depth of burial for the generation and accumulation of hydrocarbons in the basin. The reservoir rocks thus far drilled in the basin, even in the producing fields, have not had enough porosity to be conducive to the storage of large volumes of oil. Matrix porosity is very low and the accumulations of oil in sizeable quantities are therefore dependent on fracturing to create adequate porosity and permeability for production. Fractured reservoirs in Guatemala are excellent examples of those that have impressive initial production rates but die rapidly, largely because of the limited storage capacity of the reservoir. [REDACTED]

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Another type of potential prospect in this basin is under the folded mountains which border the basin on the south. Such prospects could be a continuation of the overthrust belt which extends from Canada, through the United States and Mexico, and terminates in Guatemala. To date, there have only been two exploration wells--both dry holes--drilled to confirm the presence of such prospects, and it is not possible therefore to evaluate their potential. [REDACTED]

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Amatique Subbasin

Small but very attractive prospects have been established in the Amatique basin in the Gulf of Honduras. Although exploratory drilling has not been successful to date, good oil shows have been reported in at least one location. Based on stratigraphic data derived from other exploratory wells drilled in the region, we believe a reef may lie across the Amatique basin. As a result, we expect offshore drilling activity to become an attractive alternative. [REDACTED]

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Yucatan Platform

Prospects in this region lie on the shelf area off of the Yucatan platform and north of the Libertad Arch in Guatemala and north of the Mayan Mountains in Belize. The reservoirs are similar to those in the Chapayal Basin. [REDACTED] discoveries have been made but have not yet been evaluated for production possibilities. The discoveries might be comparable to finds in the Chapayal basin. [REDACTED]

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Pacific Coastal Basin

The Guatemalan Pacific Coastal Basin contains a large, seaward thickening wedge of marine sediments. These sediments contain large amounts of volcanic

material which would sharply limit their potential as source and reservoir rocks. However, regardless of this limitation, the volume of sediments in the basin when considered with the paucity of testing/drilling makes it impossible to write the region off as having no potential.

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Appendix 3Investment Requirements: Key Assumptions

In order to assess investment requirements for the Guatemalan petroleum sector we made the following assumptions based on past exploration and development trends:

- o Drilling costs per well average \$10 million.
- o Discovery rates remain at the historic level of 1 oil strike for every 4 wells drilled.
- o Average field size per strike equals 2 million barrels with a 2,000 b/d peak capacity.
- o Development costs total 3-4 times exploration expenditures.

In addition, we assumed that the production profile of any new oilfield will resemble that of currently producing fields. These reservoirs peak relatively early--within 1-2 years of development--and then decline very sharply over the next several years before stabilizing at relatively low output levels.

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Appendix 4Impact of The Guatemalan Insurgency on Oil Prospects

The major guerrilla groups in Guatemala, while uniformly anti-US, do not pose a significant threat to the nation's petroleum sector. The groups individually have only limited capability to inflict serious economic damage and they have been unable to come together to constitute a unified opposition. For its part, the government has mounted an effective counter-insurgency program that has further inhibited the potential for terrorist operations. [REDACTED]

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The four principal guerrilla groups--the Guerrilla Army of the Poor (EGP), the Organization of the People in Arms (ORPA), the Rebel Armed Forces (FAR), and the Guatemalan Labor Party/Dissident Faction (PGT/D)--ostensibly operate under the official umbrella organization known as the Guatemalan National Revolutionary Union (URNG). The URNG, established in 1982 under Cuban tutelage, was to be the central coordinator for political and military strategy. It has never acquired that status and, in fact, remains little more than a propaganda shell. Competing personalities and a variety of ideological differences have prevented the groups from achieving unity of organization or command. [REDACTED]

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The capability to inflict damage also is limited by the Guatemalan government's strong counter-insurgency program, which makes use of aggressive patrolling techniques, a roughly 900,000 member Civilian Defense Force, and a model villages/civic action program. In addition, the cutoff in 1977 of US military assistance to the government and the minimal amount of American aid received since then have reduced the insurgents' impetus for attacking US-owned interests. [REDACTED]

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While the guerrillas could over the coming months redirect their resources to the point where they might pose a threat to the nation's petroleum facilities, they have not shown any significant inclination in this direction. The only insurgent activity against the oil industry in recent years resulted in the destruction of the powerlines to the oilfields in Alta Verapaz and Quiche Departments in early-1985. This was the first such attacks since 1981, when, in a series of incidents, the oil pipeline between Rubelsanto and Puerto Barrios, a petroleum exploration facility in the Rubelsanto region, and the Chevron oil depot in Guatemala City were hit and sustained varying degrees of damage. [REDACTED]

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